

Ramiro Morales  
State Bar No.: 7101  
William C. Reeves  
State Bar No. 8235  
MORALES, FIERRO & REEVES  
600 S. Tonopah Drive, Suite 300  
Las Vegas, NV 89106  
Telephone: 702/699-7822  
Facsimile: 702/699-9455  
E-mail: wreeves@mfrlegal.com

Attorneys for Plaintiff  
Steadfast Ins. Co.

UNITED STATES DISTRICT COURT

DISTRICT OF NEVADA

STEADFAST INSURANCE COMPANY,	)	Case No.:
	)	
Plaintiff,	)	COMPLAINT
	)	
v.	)	<b>JURY RESERVED</b>
	)	
RAY HEATING PRODUCTS, INC., RHP	)	
MECHANICAL SYSTEMS and DOES 1-20	)	
inclusive,	)	
	)	
Defendants.	)	

Plaintiff Steadfast Insurance Company ("Plaintiff") alleges as follows:

1. At all relevant times herein, Plaintiff was and is a corporation engaged in the business of issuing insurance policies.

2. On information and belief, Ray Heating Products, Inc. and RHP Mechanical Systems (collectively "RHP") were corporations engaged in the business of performing construction work.

3. DOES 1-20 inclusive are sued fictitiously based on the fact that the names of each are presently unknown. When Plaintiff discovers the names of one or more of these defendants, they will undertake additional steps to specifically name them in this case.

4. The acts and/or omissions at issue in this litigation took place in this judicial district. Venue, therefore, lies with this Court, as a substantial part of the events which are the subject of the claims asserted herein are located and/or took place in this judicial district.

General Allegations

5. Non-party United Construction Company ("United") designed and built two warehouse buildings located at 8020 and 8040 N. Virginia Street in Reno, Nevada ("Subject Properties").

6. United Construction Company entered into a subcontract with RHP to, inter alia, design and install the HVAC systems in the Subject Properties.

7. In or around 2016, the owner of the Subject Properties made a claim against United to remediate water damage and mold discovered at the properties ("Claim"). In so doing, the owners demanded that United take any and all corrective measures to repair the properties.

8. Steadfast issued United an insurance policy assigned Policy No. EOC 193620-00 (effective 05/20/16-04/20/17) ("Policy") generally affording coverage for sums an insured becomes legally obligated to pay as "Damages" because of a "Professional Liability Claim" first made against the "Insured" during the "Policy Period" and reported during the "Policy Period", the Automatic Extended Reporting Period or the Optional Extended Reporting Period if applicable for which coverage was not otherwise excluded and/or barred.

9. In response to United reporting the Claim to Steadfast under the Policy, Steadfast agreed to investigate and evaluate coverage subject to a full and complete reservation of rights.

10. Plaintiff and United entered into a written agreement whereby Plaintiff agreed to reimburse United \$1,922,413.40 for repairs it performed to the Subject Properties.

11. Pursuant both to the terms of the Policy and per law, Plaintiff is subrogated to any and all rights United may possess against others in connection with the Claim.

CAUSE OF ACTION NO. 1 - DECLARATORY RELIEF

(As Against Defendants)

12. A dispute exists in this case regarding whether Defendants are liable for the Claim.

13. This dispute presents an actual, present and justiciable controversy.

14. A judicial determination of this controversy is necessary and appropriate in order for the parties to ascertain their rights, duties and obligations regarding this dispute.

Wherefore, Plaintiff prays for judgment as hereinafter set forth.

CAUSE OF ACTION NO. 2 - NEGLIGENCE

(As Against All Defendants)

15. Plaintiff incorporates the provisions of all prior paragraphs as though fully set forth herein.

16. Defendants owed a duty of care to perform all work in connection with the Subject Properties in a competent and workmanlike manner so as to avoid causing damages.

17. Defendants breached these duties by, inter alia, causing the damages to the Subject Property.

18. As a direct and proximate result of the conduct of Defendants, Plaintiff has suffered actual and consequential damages and expenses as described herein.

WHEREFORE, Plaintiff prays for relief as set forth below.

CAUSE OF ACTION NO. 3 - BREACH OF CONTRACT

(As Against All Defendants)

19. Plaintiff incorporates the provisions of all prior paragraphs as though fully set forth herein.

20. Defendants agreed via an agreement to perform all work in a competent and workmanlike manner so as to avoid causing defects and/or damages.

21. Defendants breached these duties by, inter alia, causing the damage at the Subject Property.

22. As a direct and proximate result of the conduct of Defendants, Plaintiff has suffered actual and consequential damages and expenses as described herein.

WHEREFORE, Plaintiff prays for relief as set forth below.

CAUSE OF ACTION NO. 4 - BREACH OF WARRANTY

(As Against All Defendants)

23. Plaintiff incorporates the provisions of all prior paragraphs as though fully set forth herein.

24. Defendants warranted that they would perform their work in a competent and workmanlike manner so as to avoid causing defects and/or damages.

25. Defendants breached these warranties as their work caused damage the Subject Property.

26. As a direct and proximate result of this conduct, Defendants, Plaintiff has suffered actual and consequential damages and expenses as described herein.

WHEREFORE, Plaintiff prays for relief as set forth below.

PRAYER FOR RELIEF

AS TO THE FIRST CAUSE OF ACTION FOR DECLARATORY RELIEF:

1. For a declaration and determination that Defendants are responsible for the Claim.
2. For all other relief the Court deems just and proper.

AS TO THE REMAINING CAUSES OF ACTION:

1. For monetary damages according to proof at trial;
2. For attorney's fees and costs;
3. For all other relief the Court deems just and proper.

Dated: July 27, 2022

MORALES FIERRO & REEVES

By: /s/ William C. Reeves  
William C. Reeves  
Attorneys for Plaintiff

Accompanying Affidavit

I, William Reeves, affirm as follows:

1. I am counsel for Plaintiff Steadfast Insurance Company in connection with the above-referenced matter and affirm the following as required by NRS 11.258:

2. I have reviewed the facts of the case and have consulted with an expert that is knowledgeable in the relevant discipline involved in the action; and

3. The expert has concluded on the basis of the review and the consultation with the expert that the action has a reasonable basis in law and fact as set forth in the report attached hereto as Exhibit 1.

I affirm the foregoing is true and correct based on my own personal knowledge. Executed

1 in Concord, California on the date specified below.

2 Dated: July 27, 2022

3 

4 William C. Reeves

# Exhibit 1

# EXHIBIT 1

**Thomas A. Gilbertson & Associates, Inc.**

**216 Sandringham N.**

**Moraga, CA 94556**

**Office 916-804-9328 E-mail: tomagilbertson@msn.co**

**Engineering Report for**

**Capitol Specialty Insurance Corporation**

**v.**

**Steadfast Insurance Company**

**United States District Court**

**District of Nevada**

**Case Number . : 2:20-cv-1382-JAD-VCF**

**Report by Thomas A. Gilbertson P.E**

**July 26. 2022**



**Thomas A. Gilbertson & Associates, Inc.**

**216 Sandringham N.**

**Moraga, CA 94556**

**Office 916-804-9328 E-mail: tomagilbertson@msn.co**

**Engineering Report**

**Table of Contents**

**A. Statement of Qualification**

**B. Situation**

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**a. Thomas A. Gilbertson - CV**

# Exhibit A

**Thomas A. Gilbertson & Associates, Inc.**

**216 Sandringham N.**

**Moraga, CA 94556**

**Office: 916-804-9328**

**E-mail: tomagilbertson@msn.com**

**Reference: Capitol Specialty Insurance Corporation - v. - Steadfast Insurance Company**

**United States District Court**

**District of Nevada**

**Case Number . : 2:20-cv-1382-JAD-VCF**

**Statement of Qualifications**

**July 26, 2022 To whom it may concern:**

Attached please find the CV for Thomas Arthur Gilbertson dated March 2022 for a Partial List past Projects and assignments. I point out that I am a graduate mechanical engineer with a Bachelor of Science degree in Mechanical Engineering, from the University of Wisconsin awarded in January of 1960. Subsequently, as outlined in the CV, I was awarded Professional Engineering Licenses in California, Washington and Arizona, and Professional Contracting Licenses in California for C-4, C-10, C-20, and C-38, and in Arizona R-45.

As an officer in the U.S. Army Corps of Engineers I attended construction training at Ft. Belvoir, and Ft. Leonard Wood. Following military and civilian training I obtained a certificate from Heald's College in Construction.

My engineering licenses date from 1965 and as result I have over five decades of experience in the construction trades. Generally, I am retained by owners and/or developers to set the criteria for, and to administer the design, construction, and integration of mechanical, electrical, plumbing, fire protection systems into new and existing structures. See the Partial List of Projects in the attached CV for added experience.

I have been retained as an expert in the above listed areas of construction and Building Code-related issues, and psychrometric and thermodynamic evaluation of building conditions. As result of those assignments, I have reviewed not less than three thousand existing structures and residences. I have on occasion been appointed an Independent Evaluator by the California Superior Court and worked directly for the Superior Court. My sworn testimony as an expert of the above listed areas has been accepted in State of California, Washington, Arizona, New York,

and Illinois Superior Courts, as well as in various districts of Federal Court as in Texas – Northern District, New York – Northern District, Washington D. C. – Armed Forces Court of Appeals, United States Attorney General, and U. S. Bankruptcy Court – San Jose. and

Additionally, I hold a State of California – Certificate of Appreciation for 50 years of Service to State of California – from the Board of Professional Engineers, Land Surveyors, and Geologists.

Thomas A. Gilbertson. P. E.

**Exhibit B**

**Thomas A. Gilbertson & Associates, Inc.**

**216 Sandringham N.**

**Moraga, CA 94556**

**Office 916-804-9328**

**E-mail: [tomagilbertson@msn.com](mailto:tomagilbertson@msn.com)**

**Reference: Capitol Specialty Insurance Corporation - v. - Steadfast Insurance Company**

**United States District Court**

**District of Nevada**

**Case Number . : 2:20-cv-1382-JAD-VCF**

**Situation -**

Warehouse(s) in the Reno Area have developed a condition where the growth of biological material on the inside of the building(s) has been determined to be unhealthful, and as a result rendered the warehouse(s) unsafe for occupancy by personnel inside the building.

The remediation efforts to remove the offending unhealth material growth has exceeded several millions of dollars.

Question: Why has the above-described condition occurred?

Answer: Moisture, in the form of water vapor has entered the warehouse and a change of state of the water vapor has resulted in the water vapor contacting components of the warehouse roof. The water vapor upon falling below the dew point of atmosphere within the building forms liquid water on the cold surfaces. The liquid water “wets” the nutrient rich surfaces that result in the growth of the offending mold and spores.

Question: What is the source of the water vapor that allows the damage to occur?

Answer: The mechanical design is based upon discharging the products of combustion of the “direct-fired” natural gas heaters in the warehouse. The products of combustion of the natural gas-burning space heaters, directly discharge into the warehouse. The natural gas-burning space heaters do not use “chimneys” to place their products of combustion outside the building.

Question: If a mechanical design that were to have placed the natural gas heaters' products of combustion outside the building would the damage that the installation has suffered been avoided.

Answer: Yes

How much water DOES natural gas produce when it is burned?

Answer: Each 100,000 btus of natural gas when burned produces nominally 1.25 gallons of water. For example, a 2,00,000 btu/hr. heater will produce 25.0 gallons of water when operating at the 2,000,000 btu/hour rate.. Four natural gas heaters of the size described that discharge their products of combustion into the inside of the warehouse would produce nominally 830 pounds of water in one hour of operation. Considering that the four heaters could operate as many as 5 hours a day the inside of the warehouse building would be subjected to 4,165 pounds of water to deal with each 24 hours, with only 5 hours of operation.

Question: How could this moisture/condensation problem have been avoided?

Answer: The mechanical designer/mechanical contractor responsible for the design could have used "indirect" gas heaters. e. g. the heater type with chimneys to place the products of combustion outside of the warehouse. This would have had no water vapor from the products of combustion placed in the warehouse, and hence no water vapor to condense and cause the problem.

Question: Who or what entity is the cause of the water-vapor-condensation problem?

Answer: The firm or individual that performed the mechanical design that allowed the products of combustion to be inside the building, and hence provide, and "condense the water-component of combustion" inside the building is the source of the offending water, and the mechanical design that mandated this performance.

Thomas A. Gilbertson

Thomas A. Gilbertson P. E.

# Exhibit C



**Thomas A. Gilbertson & Associates, Inc.**  
**Engineers**  
**Moraga, California, 94556**  
**Telephone 925-376-4516 FAX 925-631-0683**

**ASHRAE Standard Format**

**1. BASIC DATA** **DATE:** March 2022  
**NAME:**

Thomas A. Gilbertson United States Citizen  
Born: November 11, 1937 La Crosse, Wisconsin

Home Address: 216 Sandringham N.  
Moraga, California 94556  
Telephone: 925-376-5843

Employer: Thomas A. Gilbertson & Associates, Inc.  
216 Sandringham N.  
Moraga, California 94556  
Telephone: 925-376-4516  
ASHRAE Member #260496

**2. EDUCATIONAL RECORD**

**Education/Institution/Course/Years/Graduation/Degree**

**High School:** La Crosse Central, 1955 Graduate

**College:** University of Wisconsin-Madison, 1960 - January Graduate, BS-Mech. Eng.

**Technical Schools:** Technician School, Johnson Service Company 1960, Milwaukee, Wisconsin  
U.S. Army - Corps of Engineer's Officer's School 1960, Ft. Belvoir, Virginia  
Heals College San Francisco

**3. ARE YOU A REGISTERED ENGINEER? YES X NUMBER OF STATES 3**

Washington 1979, Kentucky 1983, California, (two) Mechanical 1966, Instrument & Control, 1971  
Arizona 2010

**ARE YOU A REGISTERED ARCHITECT? NO**

**4. PROFESSIONAL EXPERIENCE**

**From 1981 to Present**

Thomas A. Gilbertson & Assoc. Inc/President/Consulting Engineers

**1968 to 1981**

L & H Enterprises-San Francisco/Chief Engineer/VP- Engineering/President, Consulting  
Engineer/Equipment Sales/Manufacturing/Construction, through L & H Enterprises' Inc. five separate  
divisions with offices in San Francisco, San Jose, Sacramento, Fresno, and Honolulu.

**L & H Enterprises Divisions:**

A. Thomas A. Gilbertson & Associates.....Consulting Engineers

B. SYSERCO.....Air-conditioning Service Company

C. Greveling Co.....Mechanical Contractor

D. L & H Airco.....Manufactures' Representative

E. Kulken Mfg.....Manufacturer of Industrial Air Handling Equipment

**L & H Airco** was the authorized factory representative for Chrysler Airtemp, Mammoth, Remington/Singer, Barry Blower, Twin City Fan, Allis-Chalmers Pumps, Vibration Mountings & Controls, Inc., Ceramic Cooling Tower, Tempmaster, Liebert, Contempo, and EDPAC Computer Room Units, Annubar Flow Measurement, Air & Refrigeration Company, Mark - Hot of Canada, Woods and Strobic Air Fans, Pli-O-tron Filter of Canada, Recold Cooling Tower, Bohn Air Handling, Roberts-Gordon Co-Ray-Vac, , Kulken Air Handlers, International Fan Coil,, Air & Refrigeration, Inc., and additional equipment.

#### **1959 to 1968**

Johnson Controls-Milwaukee/New Orleans/San Francisco

Test Engineer/Sales Engineer/ Responsible Managing Employee (RME) for State of California

State of California Contractor's License C-4, C-10, C-20, C-38, Boiler, Refrigeration, Steam Fitting, Warm Air Heating and Ventilating, and Electrical

#### **1959 to 1960**

U.S. Army Corps of Engineers, Ft Belvoir, Ft. Leonard Wood, Ft. Carson, Engineering Officers School

#### **1958 to 1959**

Carnes Corporation, Verona Wisconsin/Designer-Tool & Die Design, Louver and Mixing Box Design

#### **1957 to 1958**

Wolf, Kubley & Hirsig, Mechanical Contractor -Madison, Wisconsin/Draftsman-sheet metal

### **5. ASHRAE HISTORY**

Member, Joined in New Orleans 1961, Initial Grade, Member-1962

Fellow, January 1991, Distinguished 50-Year Member 2013

#### **ASHRAE Activities (Other than Chapter)**

1971-1983	T/C 8.6 Cooling Towers and Evap. Cond./Member T/C
1973-1979	T/C 5.8 Industrial Ventilation/Member T/C
1985-Present	T/C 10.2 Automatic Ice Plants & Skating Rinks/Member, Chm.T/C
1984	ASHRAE/People to People Delegation to People's Republic of China - Member
1988-1991	Region X Vice-Chairman, Research Promotion
1991	ASHRAE – Fellow – Awarded January 19, 2001
1991, 92, 93	Technology Judging Panel - Society - Technical Awards
1991, 92, 93	Vice Chairman-Research Promotion,
1994	ASHRAE Research Promotion – Society Chairman
1995-1999	ASHRAE Standards Committee
1996-2002	ASHRAE Foundation - Board of Directors
2000-2002	Refrigeration Technical Committees as Member, Vice Chair, or Chairman
	TC10.01 Custom Refrigeration Systems
	TC10.02 Automatic Ice Plants & Skating Rinks
	TC10.03 Refrigeration Piping
	TC10.04 Ultra Low Temperature and Cryogenics
	TC10.05 Refrigerated Storage & Distribution
	TC10.06 Transport Refrigeration Systems

	TC10.07 Custom Food and Beverage Display Cooling
	TC10.08 Refrigeration Load Calculations
2002	ASHRAE – Life Member
2012	ASHRAE – 50 Year Member Anniversary Certificate
2013	ASHRAE – 50- Year Distinguished Member Award
2014	ASHRAE – Distinguished Service Award
2015	ASHRAE – Distinguished Service Award

### **Chapter Activities**

Golden Gate Chapter Member Since 1962  
 President (1979-1980), VP (1979), Secretary (1978), Treasure (1977), Fog Dispenser Editor (1966 to 1972)  
 Chapter Committees: Editor - Fog Dispenser 1966 to 1972, Tech. Seminar Chairman, Technical Seminar Co-Chairman, UL Committee, Historian 2006 to present.

## **6. MEMBERSHIP AND ACTIVITIES IN OTHER SOCIETIES OR ASSOCIATIONS**

International Institute of Refrigeration	1984	Member
Society of Petroleum Engineers	1983	Member
National Society of Professional Engineers	1987	Member
International Association of Plumbing and Mechanical Officials		Member
International Thermal Storage Advisory Committee	1984	Board Member
Society of American Military Engineers-	1958- 1960 Student President	U of Wisconsin
Association of Energy Engineers	1989	Seminar
	Instructor	
"How to Meet New Ventilation Standards: Indoor Air Quality & Energy Efficiency"		

## **7. YOUR PRINCIPLE TECHNICAL INTEREST AREAS**

Thermodynamics, Refrigeration, Thermal Storage, Utility Station Cooling Towers, High-rise Office Buildings, Power Plant Ventilation, Hotel Design, Specialized Heating Systems, Life Safety Systems, Design Standards.

## **8. HONORS**

ASHRAE Certificate of Appreciation 1980 - Golden Gate Chapter  
 ASHRAE Certificate of Appreciation 1989 - Region X  
 ASHRAE Fellow Award 1991- New York Annual Meeting  
 Distinguished Military Graduate - 1960 - University of Wisconsin  
 NROTC Scholarship to Iowa State @ Ames – 1955  
 State of California – Certificate of Appreciation for 50 years of Service to State of California - 2017  
 Board of Professional Engineers, Land Surveyors, and Geologists

## **9. PUBLICATIONS**

Articles: 2          Papers: 2          Books/Manuals: 3

"An Engineering Criterion for Cost Efficient Thermal Energy Storage" San Diego Gas and Electric-1983, co-author with Wm. Richards.

"Design Work Overseas" Specifying Engineer-1983

"Engineering Manual-TES for Cooling" Pacific Gas and Electric-1984

"Engineering Manual-TES for Cooling" Arizona Public Service Company-1985

"24 Story High Rise Office Building using Ice/TES" ASHRAE Symposium-1984

"Cold Air Design-Fan Horsepower Savings using 42 F Primary Air" ASHRAE Symposium- Portland, Oregon 1986

"Ice Cools Office-Hotel Complex" Heating/Piping/Air Conditioning-1989

"A Tale of Two Hotels"...ASHRAE Presentation 2009, Annual Meeting - Louisville, KY

#### 10. PATENTS

8-United States          8-Foreign

Including: U.S: 4,446,703 Water Side Economizer, U.S. 4,565,835 Pressurized Ice Building Chilled Water Systems, U.S. 4,480,685, Hydraulic Oil Pump, Liquid Refrigerant Pump (see attached data)U. S. 4,928,493 Ice-Building, chilled water.

#### 11. PROJECTS: (Partial List of significant Projects Below)

**165,000 gpm Cooling Tower, Power Plant Site North Dakota** -1978 Design and Construction of Pre-cast Concrete Structure, Project Manager, Design of Concrete Facility to Cast Members on Site, Responsible for design and erection of Cooling Tower, design of 84-inch diameter by 500 ft long piping header system, + on-site supervision of construction at Coyote #1 Plant.

**Kanaapali Whaler--Maui, Hawaii**-1971-1973, Design of 2-12 story, 555 room condominium towers, plumbing, air-conditioning, and fire protection, early project in Hawaii to use desuperheating heat recovery for domestic hot water heating. Project uses special non-standard design, field erected cooling tower with plan size of 8 ft by 120 ft to provide garage exhaust ventilation requirements, and cooling tower fan requirements. The cooling tower/garage exhaust system saves the project in excess of 200,000 kWh per year, when compared against having provided two separate, non-integrated systems. Complete site utility plan.

**Reynolds Metals – Gregory, Texas** – 1969 – 1970, Design and manufacturer of emergency shut-off dampers for 88-inch diameter inlets to 15 wet electro-static precipitators used in pollution control system at aluminum production facility. Dampers assemblies were 26 ft tall weighing 8,000 lbs. each, with control equipment to allow complete shut-down with loss of all power. Each of the 15 units handles 85,000 cfm at 12 inches of static pressure @ 250 F using 84-inch Class IV fan with 350 hp motors.

**American Licorice Company--San Francisco, Chicago, Alsip, IL, Union City, CA**, 1969-to present. Design of Process Heating and Drying Systems for manufacture of candy at four plant sites, multiple steam and hot water boiler/process heating requirements, fire protection, including design of drying tunnels, design of computerized ingredient blending and control, and product transfer system. Three boiler house projects integrate four high-pressure steam boilers, and eight medium temperature hot water boilers to serve the facility.

**Campton Place Hotel – San Francisco** 1979-1981 Design of HVAC, Plumbing and Fire Protection for 5-Star property operated by Kempinski Hotels and Lufthansa – Bechtel Corporation performed as project development manager for Marcos Family investment including luxury dining facility; retained through Bechtel Corporation and James A. Nelson Company. Project uses mono-flow piping for heating and cooling in 4-pipe design.

**Pacific Gas and Electric--Morro Bay Power Plant--**1990-Systems Performance Review, Inspection and evaluation of system performance for Units #1,#2, #3, and #4, performed for PGandE. Design of replacement ventilation system using 3,100,000 cfm.

**34-story Westin Building, Seattle**-1979-1980, Design of Mechanical Systems, first high-rise use of water-side economizer. (see attached patent data)

**Stanford Research Institute-Menlo Park**-1984, Design of Closed-Circuit Ice-builder and extension to central plant. First direct burial of thermal storage. Project shifts approximately 640 kW from electrical peak during afternoons. Operating savings of \$60,000 to \$65,000 per year are being realized.

**China Basin Building, -San Francisco,** 1987, Design of 8,000 ton-hour thermal storage system, installed on barge anchored at wharf side.

**SS United States - 990 Ft Long Ocean Liner Conversion** -1979-1988 Representation of Owner to Shipyards for conversion work on Project for HVAC, Plumbing and Fire Sprinkler System for 1256 cabins. Review of conversion of steam power to gas turbine for power generation. Development of criteria, negotiation of contracts for refitting on Owner's behalf. Design for conversion of existing chilled water plant with eight existing centrifugal chillers to serve 1256 new guest cabins and 612 new crew cabins and seven new shipboard restaurants. HWDW, Blom & Foss, Haupauge-Lloyd, Germany and Wartsala, Finland - Shipyards

**Hospital Operating Room Air-conditioning System Design** - 1972 - 1980 Specification, design, and layout of specialized operating room ceilings using laminar flow. Integration of laminar flow devices with HEPA filters into the operating suites on Brookside Hospital, Walter Reed Hospital, and O'Connor Hospital.

**AEE Educational Seminars**-1988,1989,1990-Conducted 11 seminars on "Meeting Indoor Air-Quality Standards-Control Strategy for Meeting ASHRAE 62-89" and "Thermal Energy Storage Systems" at various locations in the United States

**IOOF Retirement Center, Ogden, Utah**-1977, design of seven story residential facility using mono-flow chilled water piping for cooling system, as well as mono-flow heating hot water system.

**Kazakhstan Medical Center, Kazakhstan** - 1994, preparation of documents to allow delivery of proposal to manage, design, construct, man, supply, and operate medical center for the Republic of Kazakhstan.

**ASARCO Tank House Ventilation System-Amarillo, Texas** , 1973, design, and installation of 2,100,000 cfm ventilation duct system using all 316 stainless-steel material.

**Palos Verde Nuclear Plant Wastewater Trickling Filter System-Arizona,** 1976, design, and installation of treatment water filter system for City of Phoenix effluent, including 280,000 cfm ventilation system for odor control.

**KIMCO Hotels/Restaurants-San Francisco**-1983 to present, design of mechanical, electrical, plumbing, and sprinkler systems for construction and/or conversion at Galleria Park Hotel, Villa Florence Hotel, Cecil Hotel Conversion, Juliana Hotel, Tuscan Inn At Fisherman's Wharf Hotel, Monticello Hotel, Harbor Court Hotel, Sir Frances Drake, Monaco Hotel, 4<sup>th</sup> and Market Street site to Hotel Palomar, retrofit of Hotel Californian ---all San Francisco, Kennedy Hotel, Arlington Suites Conversion, 4th & Spring Street Conversion-Seattle, Beverly Hillcrest, Los Angeles, F & N/Kimpton Suites, Portland, Remodel of Bismarck Hotel, Chicago, Oxford Hotel conversion to Monaco Hotel, Chicago, Title Building conversion to Monaco Hotel, Denver, Continental Bank Building

Conversion to Monaco Hotel, Salt Lake City. Masonic Temple, New Orleans, United States Tariff Building lease from GSA, Washington DC, United States Haslett Warehouse lease from GSA, San Francisco. Hotel Topaz, Hotel Rouge, Hotel Helix, Hotel Madera – Washington - DC

**Mark Hopkins Inter-Contential Hotel – San Francisco** – 1999/2002, master planning of mechanical, electrical, and plumbing systems for complete infrastructure renovation, including food service.

**San Diego Trust Building – San Diego** – 1997/1999, design of mechanical, electrical, plumbing, and sprinkler systems for construction and/or conversion of 15-story historic register building constructed in 1928. conversion of existing high-rise structure to a Marriott Courtyard Hotel. 260 rooms in a conversion with restaurant, and health club.

**Cupples Station/Westin Hotel – St. Louis** – 1998/2000, design of mechanical, electrical, plumbing, and sprinkler systems for construction and/or conversion a –, conversion of existing historic register warehouse structures to Westin Hotel. 238 rooms with fourth building as an extended stay unit with `40 additional hotel rooms, restaurant, and health facility. Structures date back to 1890 through 1918.

**Fulton Building/Marriott Renaissance Hotel – Pittsburgh** – 1998/2000, design of mechanical, electrical, plumbing, and sprinkler systems for construction and/or conversion a conversion of existing historic register structure to Marriott Renaissance Hotel with 300 rooms in a conversion of the 1908 Fulton Building with restaurant, and health facility.

**Westin St. Francis Hotel – San Francisco** – 1999/2003, revisions to chilled water plant, replacement of cooling towers, major revision to kitchen ventilation system; addition of 14-story main duct system.

**14-Story Omaha Public Power, HQ Building-Omaha**, 1985/1988, consultant to Owner for review of TES, and Mechanical Systems, including 8-story atrium and thermal storage plant.

**17-Story Campton Place Hotel-San Francisco**, 1978, Design of HVAC, and Plumbing using mono-flow for both hot and chilled water systems, and restaurant.

**20-Story 100 Spear Street Office Tower, 353 Sacramento Street Office Tower-San Francisco**, 1978, 1979, Design for owner/developer of Ice-on-Coil TES/Chilled water central plants for these two office buildings. These two buildings have the lowest cost per kWh of any buildings in San Francisco...according to the utility serving the area, Pacific Gas and Electric Company.

**Hotel Mechanical Systems**, 1969/1992 for design of retrofit, or addition of air-conditioning systems to Hotel Mark Hopkins, St Francis, Barrett Hotel, Fairmont Hotel, San Francisco, Warwick Hotel, Seattle, Makaha Surf, Honolulu.

**52-Story Bank of America World Headquarters Building, San Francisco**, 1967, Development, and sale, directly to the Bank, of the building's management and temperature control system. The system used direct, on-line, real time application of an SDS (later Xerox) Sigma II Computer to interface directly with the Johnson equipment for the building. This was a new development in 1967.

**Johnston Island/Pacific Ocean** - 1963, Special Project for Atomic Energy Commission and Holmes & Narver requiring top secret, and "Q" security clearance.

**46-Story Office Tower- Baltimore**, 1986, Development for Owner, criteria for Mechanical, Electrical, Plumbing, Life Safety, and Fire Protection.

**30-Story Office, 27 Story Hotel-Mixed Use Project-San Diego**, 1986, Emerald Shapery Center, Design, development and Criteria for Mechanical, Electrical, Plumbing, Life Safety, and Fire Protection, Consultant to Owner, Project uses TES, Reverse-Osmosis/DI Cooking Water System, Dual and shared use of Garage Exhaust and Heat Rejection systems to save both operating, and first cost. Design allows incorporation of co-generation at



Owner's option at future date. C. W. Kim – Architect, Special design for code authorities, of atrium exhausts and control approval of smoke control system.

**Sacramento Municipal Utility District, 1988** - Peer Review for developer, funded by the electric utility, to determine suitability of proposed air-conditioning system for new high-rise office building.

**AMP Corporation Plating and Metal Forming Research Facility – Ontario - 1990** – Design of “Zero” effluent plating facility for gold plating of connectors, and hydro-metallic metal forming of MilSpec components. Industrial ventilation of facility to meet pollution control distinct requirements for “Zero” effluent from plating tanks, scrubber system to insure complete recovery of all hazardous particulate from plating operations.

**KEY Arena - City of Seattle, 1993 -1995** - Consultant to City for mechanical design of 17,500 seat NBA arena project; "Supersonics". Project includes NHL standard hockey rink below basketball floor, thermal energy plant using ice storage in conjunction with existing central plant to deliver 1,000 + tons of cooling to arena

**Toyota Motor Sales - U.S.A. 1993-1995 - Ontario** - North American Parts Distribution HQ, 720,000 sq ft high bay warehouse, 48,000 sq ft office, 800,000 cfm industrial cooling system, central chilled water plant for office portion.

**Toyota Motor Sales - U.S.A. 1993-1997 - Torrance** - North American HQ Project - Central Plant - Establish criteria for design of central cooling plant, 1,500 tons expandable to 4,000 tons - revised final design to be completed as a "design/build" project, review and manage for the owner mechanical contractor selection, equipment and systems approval, review and approve all changes to mechanical contract.

**Four Hotels – Washington DC –2000 to 2002** – Complete re-build HVAC, and Plumbing systems for re-construction of hotels for Jones, Lange, La Salle – Hotel Division.

**Holiday-Inn on The Hill – Washington D.C. - 2001- 2002** - Complete redesign of existing public spaces air-conditioning, replacement of all public spaces air-conditioning equipment; hotel remained in operation during construction; using new DDC control system, for BRK Corporation.

**2 Columbus Tower – Chicago – 1999 to 2002** - 58-story apartment tower with six-level garage, construction by James McHugh Construction Company – Chicago, for Charles E. Smith Company – Baltimore, 500+ units, as MEPS design/build project for general contractor. Project uses natural gas-fire central plant with stand-alone chiller plant.

**Grand Plaza Tower – Chicago – 1999 to 2003** - 62-story condominium, two towers with retail, and eight-level above-grade garage, construction by James McHugh Construction Company – Chicago, for Magellan Development - Chicago, 490+ units, as MEPS design/build project for general contractor. One central plant to serve project with natural gas boilers and central station purchased chilled water.

**United States Depart of Justice - 1994 - 1995 - Washington D. C.** Services to Justice Department regarding *legionella* related situation in Richmond, California Social Security Building, provide expert testimony.

**Iowa Beef Packers – 1999 – Amarillo, Texas** Services to firm for design of automated cleaning system to meet Federal Standards for sanitation in meat packing facility. Process involves 500 psi, medium temperature wash system to clean 300 conveyers using anti-bacterial soap, and sanitation solution delivered through computer-controlled stainless-steel delivery equipment on 60,000 sq ft refrigerated processing g floor.

**1250 South Michigan Tower – Chicago – 2001 to 2004** - 29-story condominium with 5-level garage, construction by Walsh Group, Chicago, Illinois as MEPS design/build project 221 custom residential units, central heating plant with air-to-water heat pumps for residential units.

**River Rock Casino – 2001 to 2004 –Healdsburg, California** - Design for owner of complete, 1600-machine, 80,000 sq ft facility including 550-ton under-floor air-conditioning system utilizing 72-inch in diameter

under floor duct system, custom design of three containerized mechanical plants for air-houses, and boiler plant, 3.9 megawatt, stand alone, 3-generator, electrical plant, facility with complete kitchen facility, and 1,200-car parking garage.

**Hotel Carrillo – Santa Barbara, California - 2001 to 2004** - Design of mechanical, electrical, plumbing, and sprinkler systems for construction of new, ground-up construction using design/build MEPS Systems for Tynan Group for operation by the Mark Thomas Group.

**Marriott Renaissance Hotel – 2002 to 2007 – Providence, Rhode Island** – Services for owner to oversee mechanical, electrical, plumbing, and fire protection (MEPS) design for 324-room hotel being constructed in an existing 1924 Masonic Temple listed as a “national historical structure”, Hensel Phelps, Inc. as general contractor.

**Lake Merced Golf Club – 2001 to 2005 – Daly City, California** – Services for owner to oversee mechanical, electrical, plumbing, and fire protection (MEPS) design and construction for replacement of the 38,000 sq ft golf club house with locker, dining, kitchen, office and meeting facilities.

**Nines Hotel – Westin Project**, initially a **Marriott Renaissance Hotel – 2003 to 2008 – Portland, Oregon** – Services for owner to oversee mechanical, electrical, plumbing, and fire protection (MEPS) design for 340-room hotel being constructed in an existing Meier & Frank Department Store on an entire city block; existing structure constructed between 1908 and 1920 as a 16-story, full-block structure, with terra cotta exterior, listed as a “national historical structure”; department store to remain in operation while the top 11 floors are converted into the hotel. Hoffman Construction as general contractor

**Orchard Garden Hotel – 2004 to 2007 – San Francisco, California** – Services for owner to oversee mechanical, electrical, plumbing, and fire protection (MEPS) design for a 10-story, ground-up hotel. Project services are essentially a duplicate of those provided the **10-story Orchard Hotel - San Francisco** constructed for the same owner in the 1990's. Swinerton & Walberg as general contractor

**1250 South Michigan Tower – Chicago – 2001 to 2004** - 27-story condominium with multi-level garage, construction by Walsh Group, Chicago, Illinois as MEPS design/build project 220 custom residential units, central heating plant with air-to-water heat pumps for residential units. Russland Development.

**1400 South Michigan Tower – Chicago – 2004 to 2009** - 30-story condominium with 5-level garage, construction by Walsh Group, Chicago, Illinois as MEPS design/build project 238 custom residential units, central heating plant with air-to-water heat pumps for residential units. Russland Development.

**The Blackstone Hotel – A Marriott Renaissance Hotel Chicago – 2004 to 2008** – Services for owner to oversee mechanical, electrical, plumbing, and fire protection (MEPS) design for 331-room hotel being constructed in an existing 1908 Blackstone Hotel listed as a “national historical structure”, complete food service, James McHugh Construction Company as general contractor, for operation by SAGE Hospitality.

**Elysian Hotel & Residences – Chicago – 2004 to present** - Design of mechanical, electrical, plumbing, and sprinkler systems for construction of new, 61-story ground-up construction using design/build MEPS Systems for Elysian Development Group, LLC, & James McHugh Construction Company, for operation by the Elysian Development Group. Lucian Legrand – Architect, Hotel is now re-flagged as the **Waldorf-Astoria-Chicago**.

**Park Lafayette Towers – Milwaukee, Wisconsin – 2005** – Two – 20-story condominium towers with 5-level garage, construction by Hunzinger Construction, Brookfield, Wisconsin as MEPS design/build project for high-rise residential units, and 10 town houses, central heating plant with air-to-water heat pumps for residential units using “pumped mono-flow” system. Pappageorge-Haymes – Architect. Standard RFP for MEPS design and procurement documents.

**Wit Hotel – Chicago – 2006 to 2009** - 29-story Hotel with both guestroom and condo-style time share suites, construction by James McHugh Construction Company for ECD Development as design-build MEPS



project. Hotel to be flagged as a “Double Tree – Division of Hilton Hotels and marketed as a boutique hotel with then Double Tree chain.

**Kinzie Station – Chicago – 2005 to 2014** – 37-story condominium, “Kinzie Station – Building “B”, as first of five-high-rise towers on former rail site. **Kinzie Station East Tower and West Tower** two, 41-story buildings under construction 2007 - Design by Pappageorge-Haymes – Architects, Construction by James McHugh Construction Company for Fifield Development, Chicago, IL. **Building K-2** – 35-Story Apartment Building complete in Spring of 2013 - five buildings in total project.

**TN Building Conversion to Marriott Courtyard – 2006 – Portland, Oregon** – Services for owner to oversee mechanical, electrical, plumbing, and fire protection (MEPS) design for conversion of an existing office building into a 265-room Marriott Courtyard; existing structure constructed in the 1980’s as a 14-story office building, three floors were added as the structure was converted into a hotel. Hoffman Construction as general contractor.

**Phelan Building 2009 to Present – San Francisco** - Services for owner to oversee mechanical, electrical, plumbing, and fire protection (MEPS) “rebuild” for an existing (1908) historic building, including two-new 4,000 amp services, with the addition of an electrical vault while maintaining an existing, occupied building in operation, fire protection remodel, new core systems for air-conditioning and 20 new restrooms. Project is 280,000 sq ft.

**Virgin Hotel 2011 to 2015 – Chicago** – The first of 10 planned hotels to carry the Virgin Airways affiliation., Services for owner to oversee mechanical, electrical, plumbing, and fire protection (MEPS) design for conversion of an existing office building into a 240-room hotel in the 1928-constructed Dearborn Bank Building. – Prepare and issue criteria for Request for Proposal for the MEPS Systems. New electrical vault, all new MEPS Systems with use of purchased central chilled water. James McHugh Construction Company as general contractor., National Register of Historic Buildings.

**Old Colony Building 2012 – to 2015 – Chicago** – 17-Story “Oldest-Tallest” building in Chicago-circa 1884 – Services for owner to oversee mechanical, electrical, plumbing, and fire protection (MEPS) design for conversion of an existing office building into a 135 unit – 17 Story apartment house – Prepare and issue criteria for Request for Proposal for the MEPS Systems - existing structure constructed in the 1880’s as an office building, New electrical vault, all new MEPS Systems.. Pappageorge-Haymes-Architect, Giles and CA Ventures as owners/developer James McHugh Construction Company as general contractor. . National Register of Historic Buildings

**Equitable Building 2012 – to Present – Baltimore** – Services for owner to oversee mechanical, electrical, plumbing, and fire protection (MEPS) design for conversion of an existing office building into a 185 unit apartment house – Prepare and issue criteria for Request for Proposal for the MEPS Systems - existing structure constructed in the 1891 as 10-story office building- one of three buildings to survive the Baltimore Fire of 1904 - - all new MEPS Systems.. ARCO-Murray Company as general contractor. National Register of Historic Buildings.

**R-K-O Condominium Tower 2013 to Present - Queens - New York** - Services for developer/ owner to oversee mechanical, electrical, plumbing, and fire protection (MEPS) design for conversion of an existing office building into a 185 unit apartment house – Pei – Cobb –Freed as architect for the Project - existing structure constructed in the 1920’s as an R-K-O theater – Condominium project preserves the historic ticket lobby and foyer and rises to 17 stories with 300 condominium-residences and 300 car + parking garage. Edwards & Zuck as engineers of record. - all new MEPS Systems. - CNY Company as general contractor.

**Cermak Hotel 2014 to Present – Chicago** – 23-Story 480—room Hilton-flagged as “three style –shared brand hotel” at McCormack Place. Services for developer/owner to oversee mechanical, electrical, plumbing, and fire protection (MEPS) design for ground-up hotel with 3 separate restaurant and event venues, elevated enclosed, air-conditioned bridge from hotel property to McCormack Place. Prepare and issue criteria for Request for Proposal for the MEPS Systems Antunovich - Architects - James McHugh Construction Company General contractor.

**1200 S. Indiana Apartments 2014 to Present – Chicago** – 81-Story 792-Unit Apartment House with 14 Story Garage, Services for developer/owner to oversee mechanical, electrical, plumbing, and fire protection (MEPS) design. Rafael Vinoly-Architect, Crescent Heights-Miami, owners/developer, Prepare and issue criteria for Request for Proposal for the MEPS Systems James McHugh Construction Company, General Contractor.

**1146 S. Wabash - 2014 to Present – Chicago - 27-Story** 320 Unit Apartment House with provision for future restaurant tenant, and internal parking garage. Services for developer/owner to oversee mechanical, electrical, plumbing, and fire protection (MEPS) design. Prepare and issue criteria for Request for Proposal for the MEPS Systems Solomon Cordwell Buenz-Architect, Giles and CA Ventures as owners/developer, Lend Lease Company, General Contractor.

**1411. S. Michigan - 2015 to Present – Chicago** – 16-Story 199 Unit Apartment house with 2-Story Medical 40,000 sq ft Medical-Office Tenant and 3 Floor internal Garage. Services for developer/owner to oversee mechanical, electrical, plumbing, and fire protection (MEPS) design. Prepare and issue criteria for Request for Proposal for the MEPS Systems BKV-Architect, Russland Development as owners/developer, Lend Lease Company, General Contractor.

**3<sup>rd</sup> & Pierce - CA Ventures - 2017 to Present – Phoenix** – 30-Story- 300 Unit Apartment house with 6-Story-Garage. Services for developer/owner to oversee mechanical, electrical, plumbing, and fire protection (MEPS) design. Prepare and issue criteria for Request for Proposal for the MEPS Systems Shepley Bulfinch - Architect, CA-Ventures Development as owners/developer, UEB - General Contractor.

**450 W. Belmont – CA Ventures - 2017 to Present – Chicago** – 17-Story - 8 Unit Apartment house with a 3-Floor internal Garage. Services for developer/owner to oversee mechanical, electrical, plumbing, and fire protection (MEPS) design. Prepare and issue criteria for Request for Proposal for the MEPS Systems Antunovich Associates - Architect, CA Ventures as owners/developer, Lend Lease Company - General Contractor

**KENECT Project - 2017 to Present – Nashville** - 28-Story- 420 Unit Apartment House with provision for future restaurant tenant, and internal parking garage. Services for general contractor to oversee mechanical, electrical, plumbing, and fire protection (MEPS) design. Prepare and issue criteria for Request for Proposal for the MEPS Systems Perkins + Will - Architect, Akara Partners, - Owner/developer, James McHugh Construction, General Contractor.

**KENECT Project - 2018 to Present – Denver** - 22-Story- 417 Unit Apartment House with provision for future restaurant tenant, and internal parking garage. Services for general contractor to oversee mechanical, electrical, plumbing, and fire protection (MEPS) design. Prepare and issue criteria for Request for Proposal for the MEPS Systems Perkins + Will - Architect, Akara Partners, - Owner/developer, PCL Construction, General Contractor.

**KENECT Project - 2018 to Present – Cleveland** - 14-Story- 280 Unit Apartment House, and an 8-Screen Cinema, with provision for future restaurant tenant, and internal parking garage. Services for general contractor to oversee mechanical, electrical, plumbing, and fire protection (MEPS) design. Prepare and issue criteria for Request for Proposal for the MEPS Systems Perkins + Will - Architect, Akara Partners, - Owner/developer, Whiting-Turner Company, General Contractor.

**Alt-Grand Project – 2018 to present – Chicago** – Two – 17 story Apartment houses, total 340 Rental units with provision for future restaurant tenant, and internal parking garage. Services for general contractor to oversee mechanical, electrical, plumbing, and fire protection (MEPS) design. Prepare and issue criteria for Request for Proposal for the MEPS Systems Pappageorge-Haymes - Architect, - Owner/developer, Wood Partners, General Contractor – Walsh Construction.

**661 Lake Street – 2019 to Present – Reno** – 185-unit Student Housing – 6 Levels and separate 260-plus, Market Rate Apartments above 6-level Parking Garage with 8 Levels of Apartment above Garage for 14-story Project. Services for general contractor to oversee mechanical, electrical, plumbing, and fire protection (MEPS)

design. Prepare and issue criteria for Request for Proposal for the MEPS Systems Solomon Cordwell Buenz-Architect, Giles and Associates as owners/developer, DIANDA Construction Company, General Contractor.

**1800 West Monroe – 2020 to Present – Chicago -** 42 Unit Condominium - nominally 2,000 sq ft units. 1 level of Parking Garage with no Retail – Services for Owner to provide RFP for Design/Build of MEPS Systems. Booth-Hansen- Architects.

**1000 South Michigan – 2018 to present - Chicago -** 738 Unit House – 73-Story Project with 7 Levels of Garage Parking – “1000M Project” was originally designed as 650+ Condominiums...changed to 738 Apartment Units and reconfigured for Owner - Services for KARLIK Equities, and Time Equities -NY, and general to oversee, and select mechanical, electrical, plumbing, and fire protection (MEPS) design. Prepare and issue criteria for Request for Proposal for the MEPS Systems – Helmut JAHN Architect, James McHugh Construction Company, General Contractor.

**Forensic experience - 1967 to Present** - Upon request

## **12. CIVIC CHARITABLE AND MILITARY SERVICE**

U.S. Army - Corps of Engineers 1960-1966, Active Duty and Reserve Officer

Westlake Lutheran Church - President 1961-1962

Shepherd of the Valley Lutheran Church 1968-1974, Council Member

Holy Shepherd Lutheran Church 2004 to Present, Building Program Chairman

ESCEMT - San Francisco - Instructor 1968-1969

Instruction in drafting to group of disadvantaged men and women while they were employed in entry level positions in engineering offices.

"Homeless vs. Hotel Group, et al".....Forensic Engineering support, (pro bono) to Morrison and Foerster, Attorneys at Law, in the class action lawsuit, (pro bono) of the "homeless and disadvantaged vs. hotel owner's" law suit. We were able to prove to the court that the hotel owners did not purchase enough energy from the utility to be able to hold the City of San Francisco Housing Code mandated space temperatures in emergency dwelling units. Aged, welfare recipients were awarded damages for "unsuitable living conditions". More important was the fact that virtually all City of San Francisco, welfare funded, emergency hotel rooms and hotels for the homeless were brought into the required code compliance of providing space heat and heated domestic water as required by the City of San Francisco Housing Code. Aged plaintiffs, 80 to 90 years of age, were initially discredited as "credible" witnesses'.....however, our use of the ASHRAE based energy consumption programs revealed to the court that the "slumlords" could not have complied with the law requiring minimum space conditions because the utility bills revealed that the hotel owner's had not purchased enough fuel to hold the housing code required, space conditions.

## **13. LANGUAGES**

Read: English, German

Speak: English, German (fair), Norwegian (poor)

## **Additional Selected Material**

### **Patents:**

#### **U.S Patent #4,446,703 Water Side Economizer**

Awarded May 8, 1984, filed May 25, 1980; this patent covers the use, in multi-story buildings, of the successive use of water for heat removal in two heat exchangers. This concept is presently used by five U.S. manufactures' in their standard equipment offerings.

#### **U.S. Patent #4,565,835 Pressurized Ice Building Chilled Water Systems**

Awarded.... this patent teaches the use of safely forming ice inside a closed hydraulic system. The use of this patent eliminates the requirement for a heat exchanger in a closed hydraulic system in that ice can be formed directly in the closed chilled water piping without rupturing the storage vessel or the piping system. Further the patent teaches the use of the absolutely accurate Clapeyron pressure based method for continuous measurement of thermal storage capacity.

#### **U.S. Patent #4,480,685, Hydraulic Oil Pump, Refrigerant Pump**

Awarded....this patent, the first of a group of five patents which use the application of a "pulsed", time measured system to develop flow of fluids in remote chambers. The patent allows the hydraulic horsepower requirements to provide "lift" to producing oil wells to be reduced by as much as 40 %, when compared against present systems. Subsequent patents cover the application of pumping systems, which eliminate the use of sucker rods in the pumping of oil wells to the depth of 11,000 ft. The final patent in the series covers a system where in the requirement for production tubing within the well casing is eliminated. The patent provides for a remote "lock" and "release" system that is actuated through the subsequent application of pressure in a prescribed sequence. The release mechanism incorporates an absolute accurate shear and release lock that cannot be caused by the well environment to change the release pressure setting, when removal from the well is required. The pumping design taught in the final patent description avoids the problem of "gas lock" within the well.

Although developed primarily for the oil field the pumping system provides for simple movement of refrigerant in either single or two-phase flow with standard oil field ball valves. This eliminates requirements for honing cylinders in development of compression by direct application of mechanical forces.

Further application of this patent's pump permits the pumping of refrigerant in two phase-flow, without any danger of "slugging", or mechanical damage to the pump parts or the system piping. The refrigerant application allows pumping of any refrigerant without the requirement to use a rotating mechanical seal in contact with the refrigerant. The pump application permits the use of "oil-free" refrigerant since no lubricant is required by the pumping action. This allows the use of direct contact refrigeration without the contamination of oil, as in certain food, "chip" manufacturing, and pharmaceutical applications.

### **Selected Projects:**

#### **165,000 gpm Cooling Tower, Power Plant Site North Dakota**

On-site direction of Project, including procurement of pre-stressing forms, hoisting, cranes, and rigging equipment and site organization and coordination, and casting of pre-stressed components, as sub-contractor to Bechtel Corporation. This cooling tower project required the design of steam heated pre-stressing forms for 12'-6" wide by 55' long double tees, 1' wide by 38' long by 4' deep beams and 5" by 7" by 24' long lintels beams. We designed the

internal steam heating system, steam distribution piping and control system to allow automatic un-attended operation of the forms during the concrete curing cycle. Additionally, the complete hydraulic design of the 84" dia and 66" dia water header and 24 " dia. nozzle system, was provided. Erection of the 500 ft by 90 ft tower with its 8 foot deep basin was completed between May 1 and November 15 of the same year, 1978.

**China Basin Building, - San Francisco,** 8,000 ton-hour thermal storage system, installed on barge anchored at wharf side includes the design of piping system to allow continuous operation during tidal changes of up to 7 feet. Mechanical design integrated an existing 380-ton centrifugal chiller and two existing 125 hp reciprocating compressors.

**Publications:**

The engineering manuals were a somewhat early attempt to provide information about thermal energy storage, "TES" as it has come to be known. The manuals outlined and defined terms as they attempted to teach an awareness of what could be attained by shifting and storing cooling requirements. The manuals were used in conjunction with over 30 seminars that presented TES, and what could be expected of this, at the time, emerging technology. The manuals built on the experience obtained in the design of thermal energy storage systems in two high rise buildings designed in 1978 and 1979; the 24 story - 353 Sacramento Street and the 20 - story 100 Spear Street office towers in San Francisco. Both projects were designed using the partial storage concept and ice-on-coil systems with heat exchangers. Both of the subject projects were built at or below the same first cost as conventional systems. Both projects were built without the aid of any cost subsidy by any utility.